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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/597,653	08/02/2006	Toru Takenaka	SAT-16756	4393
40854 7590 04/14/2009 RANKIN, HILL, & CLARK LLP 38210 Glenn Avenue WILLOUGHBY, OH 44094-7808				
EXAMINER				
KING, RODNEY P				
ART UNIT		PAPER NUMBER		
4117				
MAIL DATE		DELIVERY MODE		
04/14/2009		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/597,653

**Applicant(s)**

TAKENAKA ET AL.

**Examiner**

RODNEY KING

**Art Unit**

4117

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 August 2006.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-13 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-13 is/are rejected.  
7) ☒ Claim(s) 1 and 2 is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 02 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO/S5108)  
Paper No(s)/Mail Date 08/02/2006  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Priority***

1. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in parent Application No. 10597653, filed on August 2, 2006.

### ***Claim Objections***

2. Claims 1 and 2 are objected under 35 U.S.C. 112, sixth paragraph. The phrases "priority parameter required value determining means", "base gait parameter setting means", "priority parameter asymptotic means", "new gait parameter determining means", "base normal gate parameter setting means", and "new normal gait parameter searching means" include means (or step) plus function limitations, however, the written description fails to sufficiently disclose the corresponding structure, material, or acts for the claimed functions.

Applicant is required to:

(a) Amend the claims so that the claim limitations will no longer be means (or step) plus function limitations under 35 U.S.C. 112, sixth paragraph; or

(b) Amend the written description of the specification such that it expressly recites what structure, material, or acts perform the claimed function without introducing any new matter (35 U.S.C. 132(a)).

If applicant is of the opinion that the written description of the specification already implicitly or inherently discloses the corresponding structure, material, or acts so that one of ordinary skill in the art would recognize what structure, material, or acts perform the claimed function, applicant is required to clarify the record by either:

(a) Amending the written description of the specification such that it expressly recites the corresponding structure, material, or acts for performing the claimed function and clearly links or associates the structure, material, or acts to the claimed function, without introducing any new matter (35 U.S.C. 132(a)); or

(b) Stating on the record what the corresponding structure, material, or acts, which are implicitly or inherently set forth in the written description of the specification, perform the claimed function. For more information, see 37 CFR 1.75(d) and MPEP §§ 608.01(o) and 2181.

***Claim Rejections - 35 USC § 101***

3. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 1 and 2 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The gait generating system in the disclosed application, given its broadest reasonable interpretation consistent with the specification, is considered to include mathematical algorithms that have not been

incorporated in any structural computer readable medium to produce a useful, concrete and tangible result. Claims 1 and 2 appear to be directed to ranges of values rather than ranges or values tied to a particular machine or apparatus.

5. Claims 3-9 are rejected under 35 U.S.C. 101 since they depend on Claims 1 and 2, and they do not correct the deficiency of Claims 1 and 2.

***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Referring to Claim 1: The limitations "priority parameter required value determining means", "base gait parameter setting means", "priority parameter asymptotic means", and "new gait parameter determining means" are disclosed in the specification, but there is no definition nor description of the limitations. Appropriate action is required.

3. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Referring to Claim 2: The limitations "priority parameter required value determining means", "base normal gait parameter setting means", "priority parameter asymptotic means", and "new normal gait parameter determining means" are disclosed in the specification, but there is no definition nor description of the limitations. Appropriate action is required.

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-4, 6 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Takagi (US 2002/0024312 A1).

Referring to Claim 1: Takagi discloses a system determining a gait parameter, which is composed of a set of a plurality of parameters defining a gait of a mobile robot in a predetermined period, and generating a desired gait of the mobile robot in the

predetermined period by using the determined gait parameter and a dynamic model of the mobile robot, comprising:

a priority parameter required value determining means for determining a priority parameter required value, which is the value of a priority parameter to satisfy a requirement when the requirement related to the desired gait is given and a predetermined parameter out of the gait parameter is defined as the priority parameter while parameters except for the priority parameter are defined as non-priority parameters [0132];

a base gait parameter setting means for setting, as a base gait parameter, either a gait parameter defining a reference gait of the mobile robot that is prepared beforehand or a gait parameter determined in the past so as to satisfy a predetermined boundary condition [0131];

a priority parameter asymptotic means for updating the value of a priority parameter of the base gait parameter so as to cause the value to gradually approach the priority parameter required value in steps until the value agrees with the priority parameter required value [0073];

and a new gait parameter determining means for determining in an exploratory manner a new gait parameter each time the value of the priority parameter is updated by the

priority parameter asymptotic means, the new gait parameter being a gait parameter that has a priority parameter of the updated value and that allows a gait satisfying the predetermined boundary condition to be generated by using the dynamic model, wherein if the number of updates of the value of a priority parameter by the priority parameter asymptotic means when the new gait parameter is newly determined is denoted by  $n$  ( $n$ : an integer satisfying  $n \geq 1$ ), the value of the priority parameter obtained by  $n$ -th update processing is denoted by an  $n$ -th priority parameter updated value, a new gait parameter to be newly determined is denoted by an  $n$ -th new gait parameter, and the base gait parameter is denoted by a 0-th new gait parameter, then the new gait parameter determining means is a means that sets the value of a non-priority parameter to the value of the non-priority parameter of an  $(n-1)$ th new gait parameter, defines a gait parameter, in which the value of a priority parameter has been set to an  $n$ -th priority parameter updated value, as an initial search candidate gait parameter, and searches for the value of the search object parameter, which is a predetermined parameter among non-priority parameters of the initial search candidate gait parameter, such that the value satisfies the predetermined boundary condition, thereby determining an  $n$ -th new gait parameter, and the new gait parameter determined at the last update of the value of a priority parameter by the priority parameter asymptotic means is defined as the gait parameter defining the desired gait, and the desired gait is generated by using the new gait parameter and the dynamic model [0078-0086].



Referring to Claim 2: Takagi discloses a gait generating system for a mobile robot, when generating a desired gait of a mobile robot in a predetermined period, the system determining a normal gait parameter, which is composed of a set of a plurality of parameters defining a normal gait, which is a virtual cyclic gait following the desired gait, and generating the desired gait such that the desired gait approximates a normal gait generated using the determined normal gait parameter and a dynamic model of the mobile robot, comprising:

a priority parameter required value determining means for determining a priority parameter required value, which is the value of a priority parameter to satisfy a requirement, when the requirement related to a normal gait corresponding to the desired gait is input and a predetermined parameter out of the normal gait parameter is defined as the priority parameter while the parameters except for the priority parameter are defined as non-priority parameters [0132];

a base normal gait parameter setting means for setting, as a base normal gait parameter, either a normal gait parameter defining a reference normal gait of the mobile robot that is prepared beforehand or a normal gait parameter determined in the past so as to satisfy a predetermined boundary condition [0131];

a priority parameter asymptotic means for updating the value of a priority parameter of the base normal gait parameter so as to cause the value to gradually approach the priority parameter required value in steps until the value agrees with the priority parameter required value [0073-0078];

and a new normal gait parameter searching means for determining in an exploratory manner, each time the value of the priority parameter is updated by the priority parameter asymptotic means, a new normal gait parameter, which is a normal gait parameter that has a priority parameter of the updated value and that allows a gait satisfying the predetermined boundary condition to be generated by using the dynamic model, wherein if the number of updates of the value of a priority parameter by the priority parameter asymptotic means when the new normal gait parameter is newly determined is denoted by  $n$  ( $n$ : an integer satisfying  $n \geq 1$ ), the value of the priority parameter obtained by the  $n$ -th update is denoted by an  $n$ -th priority parameter updated value, a new normal gait parameter to be newly determined is denoted by an  $n$ -th new normal gait parameter, and the base normal gait parameter is denoted by a 0-th new normal gait parameter, then the new normal gait parameter searching means is a means that sets the value of a non-priority parameter to the value of the non-priority parameter of an  $(n-1)$ th new normal gait parameter, and defines a gait parameter, in which the value of a priority parameter has been set to an  $n$ -th priority parameter updated value, as an initial search candidate gait parameter, and searches for the value of a search object parameter, which is a predetermined parameter among non-priority

parameters of the initial search candidate gait parameter such that the value satisfies the predetermined boundary condition, thereby determining an n-th new normal gait parameter, and the new normal gait parameter determined at the last update of the value of a priority parameter by the priority parameter asymptotic means is defined as the normal gait parameter of a normal gait for the desired gait, and the desired gait is generated such that the desired gait approximates a normal gait to be generated by using the normal gait parameter and the dynamic model [0078-0086].

Referring to Claim 3: Takagi discloses all of the limitations of Claim 1. Takagi further discloses wherein the total number of updates of the value of a priority parameter by the priority parameter asymptotic means is set on the basis of the difference between the value of a priority parameter of the base gait parameter and the priority parameter required value [0078-0086].

Referring to Claim 4: Takagi discloses all of the limitations of Claim 2. Takagi further discloses wherein the total number of updates of the value of a priority parameter by the priority parameter asymptotic means is set on the basis of the difference between the value of a priority parameter of the base normal gait parameter and the priority parameter required value [0078-0086].

Referring to Claim 6: Takagi discloses all of the limitations of Claim 2. Takagi further discloses wherein the normal gait parameter includes, as the search object parameter, a parameter that defines a predetermined state amount of a motion of a mobile robot at one end of the period of one cycle of the normal gait [0074].

Referring to Claim 7: Takagi discloses all of the limitations of Claim 1. Takagi further discloses wherein the predetermined boundary condition includes a condition in that a predetermined state amount of a motion of a mobile robot at a gait boundary in the predetermined period agrees with the predetermined state amount of the motion of the mobile robot in an adjoining gait at the boundary [0037].

Referring to Claim 11: Takagi discloses all of the limitations of Claim 7. Takagi further discloses wherein the mobile robot is a legged mobile robot equipped with a plurality of legs extended from its body, and the predetermined state amount includes at least one of the position of the body of the robot, the velocity of the body, the posture angle of the body, the angular velocity of the posture angle of the body, the weighted mean values of the position and the velocity of the body, the position of the total center-of-gravity of the robot, the velocity of the total center-of-gravity, the weighted mean values of the position and the velocity of the total center-of-gravity, and a divergence component [0091-0100](Fig. 1).

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi (US 2002/0024312 A1), further in view of Iribe (US 2004/0176875 A1).

Referring to Claim 5: Takagi discloses all of the limitations of Claim 1. Takagi does not disclose wherein the gait parameter includes a parameter that defines a desired ZMP trajectory out of the desired gait as the search object parameter. However, Iribe discloses a ZMP trajectory as a target in motion control while a robot is walking [0010]. Therefore, it would have been obvious to a person of ordinary skill in the art, at the time of the Applicant's invention, to modify the disclosing of Takagi to include the ZMP trajectory as disclosed by Iribe. One person of ordinary skill in the art would have been motivated to do so in order to achieve stable posture control of the robot body.

8. Claims 8, 9, 12, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi (US 2002/0024312 A1), further in view of Furuta (US 2005/0001575 A1).

Referring to Claim 8: Takagi discloses all of the limitations of Claim 1. Takagi does not disclose wherein the predetermined boundary condition includes a condition in that a predetermined state amount of a motion of a mobile robot at the boundary on the terminating end of a gait in the predetermined period agrees with the predetermined state amount of the motion of the mobile robot in the normal gait determined as a virtual cyclic gait that is to follow the gait. However, Furuta discloses an end of a walk period of a robot in a simulation of the real gait formation [0065]. Therefore, it would have been obvious to a person of ordinary skill in the art, at the time of the Applicant's invention, to modify the disclosing of Takagi to include the simulation formation as disclosed by Furuta. One person of ordinary skill in the art would have been motivated to do so in order to achieve stable posture control of the robot body.

Referring to Claim 9: Takagi discloses all of the limitations of Claim 2. Takagi does not disclose wherein the predetermined boundary condition includes a condition in that a predetermined state amount of a motion of a mobile body at the starting end of one cycle of the normal gait and that at the terminating end thereof agree with each other. However, Furuta discloses a beginning and end of a walk period of a robot in a simulation of the real gait formation [0065]. Therefore, it would have been obvious to a person of ordinary skill in the art, at the time of the Applicant's invention, to modify the disclosing of Takagi to include the simulation formation as disclosed by Furuta. One

person of ordinary skill in the art would have been motivated to do so in order to achieve stable posture control of the robot body.

Referring to Claim 12: Takagi and Furuta disclose all of the limitations of Claim 8. Takagi further discloses wherein the mobile robot is a legged mobile robot equipped with a plurality of legs extended from its body, and the predetermined state amount includes at least one of the position of the body of the robot, the velocity of the body, the posture angle of the body, the angular velocity of the posture angle of the body, the weighted mean values of the position and the velocity of the body, the position of the total center-of-gravity of the robot, the velocity of the total center-of-gravity, the weighted mean values of the position and the velocity of the total center-of-gravity, and a divergence component [0091-0100](Fig.1).

Referring to Claim 13: Takagi and Furuta disclose all of the limitations of Claim 9. Takagi further discloses wherein the mobile robot is a legged mobile robot equipped with a plurality of legs extended from its body, and the predetermined state amount includes at least one of the position of the body of the robot, the velocity of the body, the posture angle of the body, the angular velocity of the posture angle of the body, the weighted mean values of the position and the velocity of the body, the position of the total center-of-gravity of the robot, the velocity of the total center-of-gravity, the weighted

mean values of the position and the velocity of the total center-of-gravity, and a divergence component [0091-0100](Fig.1).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RODNEY KING whose telephone number is (571) 270-7823. The examiner can normally be reached on 7:30am - 5:00pm Monday - Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Khoi Tran can be reached on (571) 272-6919. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. K./  
Examiner, Art Unit 4117



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/KHOI TRAN/

Supervisory Patent Examiner, Art Unit 3664